

A CMOS-Compatible Process Technique for Fabricating Laterally Embedded Multi-Nanochannels without Sacrificial Etching

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There are increasing demands on nano-scale channels for nanobiotechnology. By miniaturizing the channels, one could facilitate the detection of individual DNA molecules and proteins by passing one molecule through the channel.

Previous methods of channel fabrication have involved the wafer bonding process to cover the trenches [1]. These are not suitable for fabricating nano-scale channels having uniform and predictable trench height as small as 100 nm. The sacrificial layer methods [2] require the sub-micron lithography equipments. And this process requires a choice of materials with extremely high degree of selectivity in the chemical etch.

The fabrication technology described in this abstract does not require the sub-micron equipments. In addition, it is a CMOS-compatible process. The nanochannels are fabricated by utilizing CMOS-compatible planar semiconductor processes such as chemical-mechanical polishing (CMP) and oxide deposition without involving nano-scale lithography equipments. This simplifies the process and thus lower the fabrication cost. In addition, a high throughput nano-system can be integrated with CMOS readout circuits. The diameter of the channel can be easily adjusted, from micro-scale to nano-scale, by changing the oxidation parameters in the process. The length and shape are determined by a single photolithography process.

References

- [1] Mathieu Foquet, et. al., "DNA Fragment Sizing by Single Molecule Detection in Submicrometer-Sized Closed Fluidic Channels," *Analytical Chemistry* 2002, vol 74, pp.1415-1422.
- [2] S. W. Turner, et. al., "Monolithic Nanofluid Sieving Structures for DNA Manipulation," *J. Vac. Sci. Technol. B* 16 (6), Nov/Dec 1998, pp. 3835-3840.